THE CUMULATION OF ECONOMIC KNOWLEDGE

I Recent Changes in Economics

Economic knowledge is so obviously inadequate for coping with society's ills that we sometimes lose sight of the progress that has been made in recent decades. Thirty or forty years ago the typical economist was a college teacher, who devoted himself primarily to speculations on the theory of value, or to the practical problems receiving public attention—such as the tariff, the property tax, labor organizations, the state of the currency, or the devious ways of monopoly. The Marshallian synthesis of economic theory was broadly accepted, and with it the reassuring principle of continuity. Most economists, deploring poverty and monopoly, felt that the state could alleviate their harsher features; but it was taken for granted that social change was and must remain gradual, and that it was not the function of economists to participate in the political processes of change. The outstanding tool of economic investigation was marginal analysis, which Ricardo had been the first to put to effective use. Economic statistics hardly extended beyond commodity prices, foreign trade, immigration, banking, and the security markets. In any event, technical specialists alone were supposed to dabble in such matters. Statistical theory was in a primitive state, little known, and little used. The warnings of a Marx, a Veblen, or a Mitchell that economists were neglecting changes in the world gathering around them, that preoccupation with states of equilibrium led to tragic neglect of principles of cumulative change, went unheeded. Even Henry L. Moore's plea for a statistical complement to pure economics was received with faint enthusiasm.

Nevertheless, the limited equipment of economists seemed reasonably adequate, as long as events moved in fairly familiar grooves and instruction of college youth was the main task of the profession. Even the outbreak of war in 1914 had slight influence on the pattern of economic thinking or responsibility until our own country entered the struggle three years later. But the war was only the first of a series of portentous developments, the last of which is not yet in sight. A single generation has already witnessed two world-wide armed conflicts, countless revolutions, the rise and fall of great empires, vast upheavals of population and

trade, marvelous advances in technology, a train of astronomic inflations, revolutionary changes in public finance, the severest business depression of which we have a definite record, and the spectre of secular stagnation. In many parts of the world independent trade unions virtually disappeared. Here they flourished despite internal strife; social insurance emerged and developed rapidly, and the hourly wage of labor moved upward in the face of grave unemployment. Still more momentous developments of our time are the rise and spread of the communist state in continental Europe, the systematic restriction of free enterprise in the land of its birth, and the vast expansion of governmental activity in our own country and elsewhere. Now, a conflict between the rival ideologies of Russia and the United States is rapidly gathering momentum, and whatever its outcome the world seems likely to remain in turmoil for many years to come.

This swift rush of events has flung economics into a position of prominence which it neither sought, nor was adequately prepared to assume. In a complex and growing civilization intricate division of labor is unavoidable. To be sure, economists were not regarded as proven experts by the community at large. But as economic problems requiring urgent attention kept coming up, a distraught citizenry turned increasingly to men who were supposed to be specialists for precise facts concerning what was going on, for explanations of the course of events, for forecasts of the shape of things to be, and for aid in devising acceptable solutions.

The most obvious effect of the upsurge in thinking about changing conditions appears in the economist's tool chest, which now bulges with devices such as index numbers, sampling theory, correlation techniques, time-series analysis, reference cycles, factor analysis, income analysis, multiplier technique, statements of sources and uses of funds, national income accounts, economic budgets, and econometric models—devices that were unknown or little used or comparatively crude a mere thirty years ago. Some of these instruments are still imperfectly conceived, and all need further testing. But the significant thing is that both the old and the new instruments are being focused on the workings of our economic organization. True, the substantive achievements have hardly begun to meet the hopes or needs of mankind. That they are, nevertheless, considerable will, I think, be clear to anyone who would compare what the best informed economists knew before World War I with what they know today about national income and its distribution, or about the rate of growth

of employment and output whether in individual industries or industry as a whole, or about the nature and forms of competition and monopoly, or overhead costs, or the behavior of wages and prices in principal markets, or consumer and business debt, or the income-generating effects of investment, and so on over a list that can be appreciably expanded. And while deepening concern with actual conditions has not yet yielded a dependable theory of the workings of the economy as a whole, that concern and nothing else explains why economic theory broke loose from its Marshallian moorings; why it moved first in the direction of monopoly and later in the direction of employment and income flows; and why the fences that previously separated public finance, money and banking, labor problems, international trade, and business cycles, both from one another and from general economic theory, have crumpled.

II The Need for Empirical Research

These, in broad compass, seem to me to be the major changes that have swept over economics in our generation. Economists are still of many schools and clash heatedly on a thousand issues. Scientific craftsmanship is still a relatively rare skill. Notable advances toward realistic thinking and toward definite knowledge have nevertheless been made. The turbulence of life has driven the economist out of his den and forced him to reckon with the changing economic scene—with mobilization for war, reparations, foreign lending or relief, inflation, depression. Urgent problems of this character cannot be handled by introspection alone, and they can be tackled in a spirit of casual empiricism only at the nation's peril.

The mounting requirements for exact economic knowledge have given a great impetus to empirical research, and the National Bureau has participated in this development. The National Bureau was established in 1920. Some of its founders were men of affairs; others were unusual scholars who had learned their economics from life as well as print. The group as a whole included men with widely dissimilar views on economic and political issues. They had, however, one aim in common: to substitute as far as possible fact for conjecture and tested theory for plausible hypothesis, in order that the world might have a sounder basis for choosing among the conflicting policies that are constantly being urged. We have clung firmly to this purpose through the years. Our publications have not urged this

or that policy on the nation, but have put steadily before the public the results of objective analyses of fundamentals that underlie the ever shifting issues of the day.

This concern with the workings of economic organization has characterized the major economic theorists. To Adam Smith the basic problem was the size of the national income, to Ricardo its distribution, to Marshall the interaction of demand and supply, to Walras the interdependence of prices, to Fisher the level of prices, to Keynes the level of employment. In the main, the theorists have explored these questions from the point of view of the economy as a whole, rather than of a particular region or industry or class. This has also been the characteristic approach of the National Bureau, although the parts that make the whole meaningful receive close attention in our studies. Like the theorists too the National Bureau has sought to separate the persistent or repetitive from the haphazard elements of experience; that is, to establish regularities of sequence and covariation among economic phenomena. But whereas the theorists have ordinarily speculated on the basis of only vague knowledge about economic quantities and relations, the National Bureau has sought to determine the magnitude of the leading economic variables, their characteristic movements over time, and their actual relations to one another. The ground covered has been smaller, but the findings have been better supported by evidence.

Of course, this difference in method reflects, in part at least, a difference in scientific opportunity. Every major theorist from Adam Smith to Keynes had a lively interest in the conditions of his time. Some, like Smith or Marshall, had great historical knowledge. Others—like Jevons, Keynes and Fisher—had a good eye for statistical methods. Every one of them had some familiarity with statistical data, made some use of them in his work, and stimulated others to examine facts. If they did not do so in greater degree, the reason is partly that the data needed often did not exist, or were not to be trusted unless subjected to laborious and time-consuming tests or revisions—a task the single-handed investigator could rarely undertake. Adam Smith's famous declaration that he had "no great faith in political arithmetic" was not a hostile or flippant utterance, but a confession by a good scholar that he could not "warrant the exactness" of the "computations" at his disposal.

Seldom have the statistical data available to the economist been gathered to serve a purely scientific purpose. To a very considerable degree, they

are byproducts of administrative operations by government or private enterprises of different sorts. Some branches of activity are not covered by statistical data at all, either because they have not yet become matters of social concern or because they present unusual problems of measurement. Statistical data often do not become available until a problem—whether it be unemployment, the length of the working day, or the rate of formation of new firms—is generally recognized as pressing. This means that many problems regarded as sufficiently urgent to call for action must be dealt with on an inadequate basis of fact. What data are available are often hard to compare or combine, and even when homogeneous may not be available as frequently as is desirable for scientific purposes. Finally, the statistical data with which the economist must work commonly stop at the surface of economic life. They record the results of mass activities, but do not penetrate to the motives that twist and drive the consuming and producing units of society.

These difficulties have been reduced by the vast extension and improvement of economic statistics in recent years, but they have not been swept away. Nor will they ever be in a complex and rapidly changing world. As a consequence, fruitful empirical research calls for a combination of qualities that is not yet widespread in economics. Like the formal theorist, the realistic investigator must have the ability to formulate economic concepts and to think through economic relations precisely. He must put definite questions to statistical data, yet be ever ready to reformulate his questions in the light of accumulating evidence. He must have the patience to examine with meticulous care the economic coverage and representativeness of the statistics that lie at hand; the enterprise to seek out remote and inaccessible bodies of information; the imagination and technical skill to devise appropriate methods of relating, combining, reducing, or decomposing statistical observations; the personal industry or the clerical assistance to carry through these laborious operations; the common sense to make full use of nonquantitative information about commercial markets and processes; the conscience to test results repeatedly against fresh observations; the character to scrap results if error or unconscious bias is spotted; the fortitude to expose his materials and methods to the public's gaze; the wisdom to seek the help of others who might make his own best efforts obsolete. This process of constructing an analytical framework, seeking out observations, processing them, reshaping the framework, seeking out new observations, and so on, is the continuous and well

tried method of science. If it is followed persistently in economics, the results will be cumulative and a body of scientific knowledge will gradually take shape.

III How Knowledge Cumulates

That this expression of faith has some basis in experience I think I can make clear by an illustration. One of the perennial problems of economic analysis centers around the formation of capital—or, as it is now usually called, investment. Different aspects of capital formation have attracted attention at different times. Without capital, division of labor is virtually impossible. With it, roundabout processes of production can be started and industrial efficiency increased. This is the aspect of the problem on which the classical economists concentrated. They realized that incomes were generated by investing; that a 'revulsion of trade' ordinarily meant a shrinkage of investment, and that employment suffered as a consequence. But they paid little attention to these matters, considering them of minor and temporary importance. Modern economists, on the other hand, characteristically take for granted the role of capital in economic progress, and concentrate on the influence of investment on current employment and income.

Many proposals for mitigating the fluctuations of investment or raising its level have been advanced in our time, and they have rested on different hypotheses concerning the underlying process. Economists have tried to explain the behavior of investment in terms of variations in construction costs, in terms of expectations concerning the rate of profit relative to the going rate of interest, in terms of the demand for consumer goods or its rate of change, in terms of changes in the money supply, in terms of technological progress and innovations, in terms of the rate of change in population or national income, in terms of policies of government or of the banking system or of trade unions. Baffled by these diverse explanations and impressed by the instability of investment, some economists have taken refuge in the hypothesis that investment as a whole, or at least a very substantial portion of it, is an 'autonomous' or 'spontaneous' variable in the economic system. This and other hypotheses have been able to thrive because our factual knowledge of investment has been scanty.

The early publications of the National Bureau recognized the instability of investment, and its great influence on economic conditions at large.

But the "fragmentary and ambiguous" character of the statistics, as Oswald Knauth summed up the situation in the early 'twenties, severely limited analysis. The only branch of investment that received systematic attention was construction work. At first, this was a technical consequence of preparing estimates of national income by industrial divisions. But there was also a great deal of discussion during the 'twenties of the possible use of public works as a balancing factor in the economy. After the stock market crash of 1929 interest in public works was intensified, and there was a demand for accurate information on the investment goods industries in general. Our publications of that period reflect the great concern over investment, but they reflect also the inadequate information that existed. In 1929 King estimated the volume of construction in the United States during 1928 at 7.8 billion dollars. Next year Wolman raised the figure to 9.9 billion. A little later Gayer came out with a figure of 13.0 billion and Kuznets with 15.9 billion. I do not think it a great exaggeration to say that up to the 'thirties our knowledge about the volume of investment in the United States was hardly more secure than was knowledge about the earth's population at the close of the seventeenth century, when the learned priest Riccioli estimated the "true number of mankind" to be 1,000 million and the political arithmetician Petty put the number at no more than 320 million.

The amount of investment is, of course, a more elusive quantity than the number of mankind. The latter is mainly a question of fact, the former involves also difficult questions of concept. An important step toward clarifying the problem was taken by Wesley Mitchell in *Business Cycles: The Problem and Its Setting*. Mitchell observed that consumption in any given year was not limited rigidly by that year's income, since a nation could draw on its accumulation from past efforts. But how large was this accumulation? And what portion of a year's income was typically added to it? To answer the second question Mitchell used the fragile but instructive estimates by King and Ingalls. To answer the first question he turned to estimates of wealth by the Bureau of the Census for 1922. After omitting the value of land, he got a total for man-made appliances that was three to four times as large as the year's national income. This total, it turned out, included inventories with a value almost as large as all movable industrial equipment, and 'furniture and personal effects' of still larger value. Mitchell therefore concluded that students of business cycles who wish to follow realistically the investment process cannot confine

attention to buildings, machinery, and public utility equipment; they must take account also of consumer durable goods and the additions to or drafts upon the nation's vast reservoir of inventories of raw materials, semifinished products, and finished goods.

Mitchell's analysis was a brief excursion, incidental to another and larger theme. The same was true of Mills' interesting measurements of the aggregate output of finished durable goods, and of other more limited efforts by our staff. However, these side explorations yielded valuable insights into the problem of investment, uncovered new materials, and suggested new approaches to measurement. In combination they indicated that knowledge might be advanced rapidly by a new project concerned exclusively with investment. When the Social Science Research Council proposed late in 1932 "a statistical study of the formation of capital during the 1920's in terms of commodities and services", the National Bureau eagerly accepted the invitation and help of the Council. The investigation was started in January 1933, with Simon Kuznets in charge. To this study Kuznets brought, besides his own invaluable experience in measuring national income, a full knowledge of the Bureau's earlier work.

What Kuznets sought to do I can convey best, perhaps, by a paradigm. Imagine a huge vacant lot on which every member of the gainfully occupied population plies his trade. When a tangible product flows from economic activity it shows up on the lot; otherwise, let us say, some token is deposited there. During the course of a year each of us tears down the pile on the lot as well as builds it up; we build up the pile by placing there our product, we tear it down by withdrawing this or that for consumption. At the end of the year what is left on the lot represents the year's accumulation by the nation, or its investment. If every item on the lot has a valid price tag attached to it, the amount of investment can be ascertained by straight addition. What does the investment consist of? It includes, first, all residential buildings, factories, waterworks, roads, bridges, and so on—that is, construction of 'permanent improvements'. It includes, next, tools and machinery, trucks, tractors, railroad cars, and so on—that is, producers' equipment of movable durable goods. It includes, third, raw materials, semifinished goods, and products ready for final use—that is, inventories of all sorts. These three categories comprise everything on the lot. The sum of their values, nevertheless, will not measure investment under conditions differing from those I have envisaged. For if a portion of the stuff produced on the lot was shipped

abroad and no compensating product received in return, a claim has been acquired against foreign countries and its amount must be counted in the year's investment. Any addition to the stockpiles within households should likewise be included, and anything that smacks of a capital gain excluded. Finally, I have assumed that the 'lot' is empty at the beginning of the year, whereas in fact it is piled high with the accumulations of generations; hence the value of the pile at the year's start must be deducted to get the net investment of the year. The magnitude of net investment is, of course, vital in judging the economic prospects of a nation in the long run. But to gauge the current activity associated with the building up of capital, it is desirable to combine the replacements of structures and equipment with the net additions. The resulting quantity is the gross investment or, in Kuznets' phrase, gross capital formation.

I hope this brief sketch has at least identified Kuznets' broad objective. By the middle of 1934 he had completed a preliminary investigation, which was published as *Bulletin* 52. The bulletin presented annual estimates of gross investment in the United States from 1919 to 1933. Changes in consumer stockpiles were omitted, except for gross additions of durable consumer goods. Otherwise, the totals were complete in principle. They included construction, the flow of durable equipment to enterprises, the flow of durable commodities to consumers, net changes in business inventories, and net changes in claims against foreign countries—each expressed both in current and in constant prices. The new series, especially the data on inventories, were highly suggestive, and the results as a whole seemed promising enough to justify expanding the investigation.

One particularly dark corner of the investment problem was the consumption of capital—more precisely, the value of durable goods used up in the course of producing commodities and services. Solomon Fabricant began work on this baffling subject. A little later David Wickens joined the staff to try his hand at developing basic estimates for residential real estate—a great segment of the nation's wealth largely neglected by economists. In the meantime Gayer continued his research on public works. Each of these studies eventuated in an important publication: Gayer's *Public Works in Prosperity and Depression* appeared in 1935, Fabricant's *Capital Consumption and Adjustment* in 1938, and Wickens' *Residential Real Estate* in 1941. Long before these volumes saw daylight, some of the leading results were published in our *Bulletin*. Of course, the results were available at all times to the staff, and Kuznets was in a position to profit

continuously by the work of his colleagues. He made constructive use of the opportunity. By adopting Fabricant's measures of capital consumption, he was able to pass from gross to net investment. By adopting Wickens' data on nonfarm residential building and Gayer's on public works, he was able to improve his own treatment of construction. But Kuznets did not confine revision to these matters. On the contrary, he bolstered the authority of his earlier work by testing and revising every part of his preliminary investigation. A summary was published in 1937 in *National Income and Capital Formation.* The following year in his monumental volume *Commodity Flow and Capital Formation,* Kuznets demonstrated at length how a skilled investigator can transform a nondescript mass of fragmentary data, scattered over hundreds of sources, into a coherent account of aggregate investment and its major components.

The new measures quickly attracted attention, and they have greatly influenced both economists and men of affairs. It is easy to see why that happened. Thinking men were much exercised about the low volume of investment in the 1930's; but they had only vague and conflicting notions about the actual volume of investment, or the importance of its leading parts, or the drop of different categories of investment from the level of the 1920's. Kuznets supplied the essential information in a well considered analytical setting. He found, for example, that out of every $100 of national income during 1919-35, only $2.40 was devoted to expanding business plant and equipment. All channels of investment together absorbed $8.30; the remaining $91.70 was spent on consumer goods. These remarkable figures, however, give no inkling of the expenditure on replacing capital goods. Since the provision of replacements is a vital part of the activity of the capital goods industries, Kuznets set forth also the record of gross investment—which includes replacements of durable goods as well as the additions. On a gross basis, investment during 1919-35 was 19.2 per cent of the gross national product (which exceeds national income by the amount that gross investment exceeds net investment). The results can be put this way: out of every $100 of gross national product, $80.80 was expended on ordinary consumer goods, $3.60 on residential construction; $10.40 on business plant and equipment, $1.00 on additional business inventories; $3.60 on governmental plant and monetary stock; $.60 on the foreign balance. But $9.50 of the $80.80 spent by households went into durable consumer goods. If these too are counted as investment purchases, gross investment comes out 29 per cent of gross national product.

The new findings by Kuznets and Fabricant inevitably raised questions about the part played by investment in earlier stages of the nation's history. If investment averaged only some 8 per cent of national income since 1919, what was it in the boisterous past? Was the increase in the government's share of investment since 1919 a new development or merely a continuation of a trend deeply rooted in social evolution? Was the marked instability of investment a recent phenomenon or an abiding characteristic of the capitalist process? These questions, and others like them, are obviously of first-rate theoretical interest. Being hotly debated in the late 'thirties, they were of practical importance as well. But before specific problems of secular change could be tackled with any confidence, new information had to be acquired, and this was bound to prove increasingly difficult as the statistical clock was turned further back.

William Shaw undertook the task with full knowledge of the risks, having served previously as Kuznets' associate. After several years of unremitting labor, he attained what seemed to be good estimates of the flow of perishable, semidurable, and durable commodities to consumers, of durable equipment to producers, and of building materials to construction sites—all expressed in producers' prices for every year since 1889 and decennially since 1869. Some of Shaw's results were released in 1941 in *Occasional Paper 3,* and the fully documented final report was published last year under the title *Value of Commodity Output since 1869.* Perhaps the most important result of this study is the demonstration of the increasing role of consumer durable goods in the nation's economy. According to Shaw's measurements, the physical flow of all finished commodities into domestic consumption increased at an average annual rate of 3.2 per cent between 1879 and 1939. The rate of growth of consumer durable goods was half again as large, 4.7 per cent. As a consequence the share of consumer durables rose from 9.6 per cent of the value of finished commodities in 1879 to 18.1 per cent in 1939. The increase before World War I was slight. The big jump occurred after 1914, and it exceeds any change in the nation's habits of consumption previously experienced, at least since the eighteen-seventies.

Just as Shaw's research grew out of Kuznets' original study of capital formation, so Kuznets' later research grew out of Shaw's work. The estimates prepared by Shaw did not of themselves reveal what portion of national income consisted of investment. Before that could be ascertained, the estimates had to be transformed and amplified. Kuznets' efforts in

this direction are recorded in *Occasional Paper 6* and *National Product since 1869*. It appears from the new study that about 91 per cent of the output of the American economy from 1869 to 1938 can be traced to the doors of consumers. The remaining 9 per cent is the net investment of the period by government and private enterprise. The government's share has been increasing for many years, but more rapidly since 1919. During the 1930's investment as a whole diminished to a mere trickle. In the preceding sixty years it had been very considerable by comparison, averaging 12 per cent of the national income. Not only that, but the fraction of national income added to capital was nearly constant, decade after decade. It is common knowledge that family incomes have generally risen over the decades, and that in any one year the proportion of income saved is higher for families with large incomes than for families with small incomes. In view of these facts, the nearly constant ratio of investment to national income almost certainly implies that the American public accommodated itself in the past to progressively higher incomes by spending a progressively larger amount out of income of any given size.

The studies I have just sketched were designed primarily to determine the characteristic magnitude of investment, its division into major components, and broad secular changes. But the investigators concerned with these questions were in continuous touch with our Business Cycle Unit, and made important contributions to its work. Although the great instability of investment had long been familiar from sample data, the comprehensive summaries by Kuznets and Fabricant provided a check on existing knowledge and added to its definiteness. Their records demonstrated that net investment is even more volatile than gross investment. This was to be expected from ordinary practices of charging depreciation; but before the results were finally assembled, I do not see how anyone could have argued with much force that net investment is positive in years of depression as well as years of prosperity. Yet, except for the catastrophe of the early 1930's, that is what the Kuznets-Fabricant figures show. Another basic finding relates to inventory investment, which according to Kuznets' data regularly alternates between substantial plus values in prosperity and minus values in depression. Not only has this segment of investment conformed with great sensitivity to business cycles, but its fluctuations have been so enormous that they account for about half of the amplitude of the cyclical swings in gross investment between

the two wars, and for more than a fifth of the amplitude of the cyclical swings in gross national product.

The arresting fluctuations of inventory investment became the starting point of a special investigation of inventories by Abramovitz. His study of inventory holdings by manufacturers during business cycles is virtually completed, and a summary will be published promptly as *Occasional Paper 26*. Abramovitz' first task was to supplement Kuznets' comprehensive annual aggregates by monthly records of inventories held at many different points in the system. The evidence indicated that although new inventory investment by manufacturers tended to move coincidently with the business cycle, actual holdings of inventories lagged by about six to nine months; in other words, inventories continued to rise some months after production had begun to decline, and continued to fall some months after production had begun to rise. This systematic lag is a net resultant of widely different circumstances surrounding the holding of distinct classes of inventories—raw materials, goods in process, and finished goods. Goods in process, for example, rise and fall in almost perfect unison with output. This is a technical corollary of the production process itself, as is the similar behavior of inventories of finished goods made to order. Inventories of raw materials, on the other hand, lag behind cycles in output by about four months; the lag is usually shorter when the materials are secured from domestic manufacturers or dealers, and again longer when secured from distant sources or on long-term contracts. Much the longest lag characterizes inventories of finished staples sold from stock. When sales decline, manufacturers as a rule reduce their output promptly; but the reduction is not sufficient to overtake the decline in shipments, and inventories therefore pile up for a year or even longer. Clearly, the movements of inventories can be understood only by observing the technical processes and marketing arrangements that impede here and facilitate there the efforts of business men to adjust their inventories to changing requirements. Abramovitz' great contribution consists in demonstrating that inventories are not a homogeneous mass, that their behavior does not lend itself to aggregative analysis; but that economic law nevertheless governs the process of inventory accumulation and decumulation.

IV The Path Ahead

Every investigator whose work on investment I have touched in these hurried pages has consolidated knowledge at some point, and broken new scientific ground at another. In this group belong, of course, many scholars outside the National Bureau, notably the economists working on capital formation at the Department of Commerce. Each investigator has made progress by building on the work of his colleagues or predecessors—adding new facts, mending old series, often clarifying concepts, and always trying to see how the pieces at hand fit together. If so much has been accomplished in a bare twenty years, is it too much to claim that economics is already assuming, however hesitantly and gradually, the shape of a body of knowledge cumulating in the spirit of science? Everything I have said of the National Bureau's studies of investment seems to point to this moral and to justify this faith. And the illustration I have developed is by no means an isolated one. I could equally well have taken Stigler's recent essay on *Trends in Output and Employment* as a point of departure to illustrate the cumulation of knowledge of industrial productivity, or the new *Technical Paper* on bond yields by Durand and Winn to illustrate the cumulation of knowledge of interest rates, or the *Technical Paper* on a federal financial statement by Copeland to illustrate the beginnings of what I trust will be a cumulative process of expanding realistic knowledge of money flows. And if I followed any one illustration far enough I would surely encompass before long all the others, as well as much of the extensive research of other economists on which our own work so largely rests. For the economic process is one whole, and so in the course of time must become our knowledge of it.

But before this goal can be attained, there is much fundamental work to be done on limited sectors of the economy—construction expenditures, consumer outlays, farming, finance, foreign trade, and the like. Economics is still in its infancy, and must not overreach its strength. Preliminary attempts at integration of knowledge won from stubborn facts must nevertheless go on, both for their own sake and to guide specialized inquiry. Wesley Mitchell's essay summarizing the findings of our business-cycle studies, which I hope will be published fairly soon, is a significant step in this direction, and other large efforts at integration and interpretation of results will follow.

As economics moves forward, many contradictory movements are vis-

ible on its surface. But the habit of insisting upon evidence is spreading, and today evidence less often means deduction from untested premises. Economic models continue to receive hopeful attention; but mere logical consistency or aesthetic appeal now counts for less, and performance under test for more, than a generation ago. Ever widening circles of men are recognizing that a piece of research whose reliability can be accepted is a great economizer of human energy. The path ahead of the National Bureau is clear: We must continue to insist on thorough and realistic scholarship as we press our closely related investigations of the workings of economic organization, for we are traveling a road along which economic knowledge will cumulate.

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